WHAT IS CLAIMED IS:

1. A disc drive, comprising:

a disc pack;

an actuator with an actuator position controllable by a control signal u;

a read/write head coupled to the disc pack and the actuator and providing a signal representing a sensed actuator position "$\theta$";

a controller circuit receiving the signal representing the sensed actuator position "$\theta$" and adapted to receive reference data indicating a desired actuator position "$\theta_d$" and adapted to store adaptive parameter data "$\hat{A}$", the controller circuit generating the output u derived from the formula:

$$\hat{A}\left(\ddot{\theta}_d + 2\lambda\dot{e} + \lambda^2 e\right) + k\left(\dot{e} + 2\lambda e + \lambda^2 \int_0^t e d\tau\right)$$

in which "$\lambda$" is a controller zero value, "k" is a controller gain value, "t" is time, and "e" is a difference between the desired actuator position $\theta_d$ and the sensed actuator position "$\theta$".

2. The disc drive of Claim 1, wherein the controller gain "k" is in the range of:

$$k > \frac{\lambda A}{2}$$

and A is a selected nominal fixed value corresponding with a range of actuator gains.

3. The disc drive of Claim 1 further comprising:
an adaptive system generating the adaptive parameter data "Â" according to an update equation: $\tilde{A} = e_1 e_2$.

4. The disc drive of Claim 3 wherein the adaptive system generates the adaptive parameter data "Â" according to the formula:

$$\tilde{A} = \left(\ddot{\theta}_d + 2\lambda\dot{e} + \lambda^2 e\right)\left(\dot{e} + 2\lambda e + \lambda^2 \int_0^t e d\tau\right)$$

5. The disc drive of Claim 1 wherein the controller circuit is a discrete controller.

6. The disc drive of Claim 5 wherein the output "u" comprises a controlled electric current supplied to the actuator.

7. The disc drive of Claim 6 wherein the controlled electric current is controlled by pulse width modulation.

8. The disc drive of Claim 6 wherein the controller circuit further comprises a digital-to-analog converter providing the controlled electric current.

9. The disc drive of Claim 6 wherein the read/write head reads the sensed actuator position $\theta$ from the disc pack.

10. A disc drive with a circuit adapted to control an actuator position, comprising:

a first controller input adapted to receive reference data indicating a desired actuator position "$\theta_d$" ;

a second controller input adapted to receive error data indicating a difference "e" between a desired actuator position and a sensed actuator position "$\theta$";

a third controller input adapted to receive adaptive parameter data "$\hat{A}$" ;

a controller output "u" adapted to provide a control signal to the actuator; and

a first controller circuit that receives the first and third controller inputs and calculates a first partial controller output G3(s) as a function thereof;

means coupled to the second and third controller inputs for deriving a second partial controller output G1(s) + G2(s) according to the transform formula

$$\frac{(k + 2\lambda A)\, s^2 + (2\lambda k + \lambda^2 A)\, s + k\lambda^2}{s}$$

in which "$\lambda$" is a controller zero value and "k" is a controller gain value and "s" is the Laplace transform variable; and

a summing circuit that combines the first partial controller output G3(s) and the second partial controller output G1(s) + G2(s) and provides the controller output U(s) = G1(s) + G2(s) + G3(s).

11. The disc drive of Claim10 wherein the second controller circuit is stable as defined by the Routh stability criteria.

12. The disc drive of Claim 10 wherein the calculations in the first and second controllers are calculated according to an error model.

13. The disc drive of Claim 10 wherein the read/write head reads the sensed actuator position $\theta$ from the disc pack.

14. A method of controlling an actuator position in a disc drive, comprising:

(a)acquiring and storing current (Nth) updates of a position error signal e and a setpoint $\theta_d$ in a memory;

(b) making current (Nth) and past ((N-1)th, (N-2)th) values of error signal e , estimate $\hat{A}$ and setpoint $\theta_d$ available for real time calculation by retrieving them from memory;

(c) digitally calculating a first derivative of error signal e, an integral of error signal e, and a second derivative of setpoint $\theta_d$ using the values retrieved in step (b) above;

(d) adaptively updating the parameter estimate $\hat{A}$ and calculating an updated controller output u by using the derivative and integrals calculated in step (c) above and adaptive parameter data $\hat{A}$; and

(e). iteratively repeating steps (a), (b), (c) and (d) above in real time in a discrete controller.

15. The method of Claim 14 wherein the controller output u is controlled according to the equation:

$$u = \hat{A}\left(\ddot{\theta}_d + 2\lambda\dot{e} + \lambda^2 e\right) + k\left(\dot{e} + 2\lambda e + \lambda^2 \int_0^t e d\tau\right)$$

in which "λ" is a controller zero value and "k" is a controller gain value and "t" is time.

16. The method of Claim 15 wherein the adaptive parameter data Â is updated according to the formula

$$\tilde{A} = \left(\ddot{\theta}_d + 2\lambda\dot{e} + \lambda^2 e\right)\left(\dot{e} + 2\lambda e + \lambda^2 \int_0^t e d\tau\right)$$

17. The method of Claim 16 wherein the update of adaptive parameter data is updated digitally in real time using instructions stored in a computer readable program storage device.

18. The method of Claim 14 wherein the actuator is a voice coil motor in a disc drive.